

An Announcement of Recent Acquisitions. . .

HSL No. 71-21
July 30, 1971



THIS ISSUE CONTAINS:

HS-009 378 - HS-009 473
HS-800 316
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HS-810 173

HSL No. 71-21 July 30, 1971

HS-009 378 - HS-009 473, HS-800 316, HS-800 506 - HS-800 507, HS-810 173

INTRODUCTION

Publications announced in *Highway Safety Literature* include the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 71 designates the year and 1, 2, 3, etc. the individual issues. To aid the user in location citations by the HS-number, the cover bears the inclusive entry numbers for each issue.

Entries in *HSL* are arranged according to the revised NHTSA Subject Category List shown in the Table of Contents. The List is a two-level arrangement consisting of five major subject fields subdivided into 58 subject groups. Documents related directly to the National Highway Traffic Safety

Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series), NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration. HS-800 000 series, and HS-820 000 series are available for purchase from NTIS or GPO (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

SAMPLE ENTRIES

Subject Category Array —————

NHSB Accession no..... HS-800 218 Fld. 5/21; 5/9

Title of document..... AN INVESTIGATION OF USED CAR SAFETY STANDARDS-SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L

Personal author(s)..... by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams

Corporate author..... Operations Research, Inc.

Collation —————

Publication date..... 12 Sep 1969 150p
Contract FH-11-6921
Report no. ORI-TR-553-Vol-6; PB-190 523

Abstract..... Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks.

Search terms: Wear Trucks;
Failures; Used cars; Inspection
standards

HS-004 497 Fld. 5/19

**AUTO THEFT--THE PROBLEM
AND THE CHALLENGE**

by Thomas A. Williams, Sr.

Journal citation . . . Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on antifithef devices available now or in the planning stage.

Search terms: Theft, Theft protection, Stolen cars

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NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community. While brands names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not, under any circumstances, be construed as an endorsement or an approval by the U. S. Department of Transportation, National Highway Traffic Safety Administration of any particular product, course, or equipment.

**AVAILABILITY OF DOCUMENTS
AND
INSTRUCTIONS FOR ORDERING**

Department of Transportation personnel may borrow copies of publications directly from the NHTSA. Outside the Washington, D.C. area, phone (202) 426-2768. In Washington, D.C. area, use government ID, phone 118-62768. Non-DOT personnel should contact their company or agency libraries for assistance.

Journals cited may be obtained through most research libraries.

Contractors' reports and other documents can usually be obtained as indicated under AVAILABILITY. However, there is no certainty that retention copies will be available for more than a limited period after a document is issued.

The more common distribution sources are identified by symbols which are explained below:

NTIS: National Technical Information Service, Springfield, Va. 22151. *Order by accession number: HS, AD, or PB.* Prepayment is required by NTIS (CFSTI) coupon (GPO coupons are not acceptable), check, or money order (made payable to the NTIS), *HC* (Paper copy; full size original or reduced facsimile) \$3.00 up; *MF* (microfiche approximately 4x6" negative sheet

film; reader required) \$0.95.

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Give corporate author, title, personal author, and report number. Prepayment is required by GPO coupon (NTIS [CFSTI] coupons are not acceptable), check or money order (made payable to the Superintendent of documents).

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418.

NHTSA: National Highway Traffic Safety Administration General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874),

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report numbers. Prices given are list; discounts are available to members and sometimes to libraries and U. S. Government Agencies. Prepayment is required; orders without payment are subject to a \$1 handling charge.

IMPORTANT NOTICE

WHEN REQUESTING a document, to be absolutely sure you receive what you order, give the accession number (HS, PB, AD number) or report number (in cases such as an SAE document), title of report, and the personal or corporate author (whichever is cited). When requesting an HS-numbered document from NTIS (CFSTI), add DOT/to the prefix HS-; example HS-800 000 should be ordered as DOT/HS-800 000.

1/0 ACCIDENTS

1/3 Investigation

HS-009 378 Fld. 1/3; 1/5

COST OF ROAD ACCIDENTS

by Urpo Leppanen

Central Organisation for Traffic Safety
in FinlandPublished in *Reports from TALJA* n10
p1-23 (1970)

12 refs

This study was published in Finnish in
Taljan Tutkimuksia n13, 1968.

Calculations of the cost of road accidents have been made in various countries but they have been rather approximate and not far developed in the theoretical sense. The purpose of this study was to give some impression about the size of accident costs. In Finland about 2 million mk were allocated for traffic safety work in 1966. This is about 0.4% of the estimated cost of traffic accidents in the same year. The sum used for traffic safety is very small in comparison to the cost of road accidents. There should be a considerable increase in allocations for road safety in the future.

Search terms: Accident costs; Accident statistics; Economic analysis; Life years lost in accidents; Life value; Fatalities; Worklife expectancy; Injury costs; Accident severity index

HS-009 379 Fld. 1/3

ANALYSIS OF RELIABILITY OF
ACCIDENT INFORMATION OBTAINED
FROM OFF-THE-SCENE SOURCES, PT. I

by J.P. Gerrard; W.W. Mosher, Jr.

California Univ. ITTE

Dec. 1968 66p 25 refs

The primary objective of this project was to test the reliability of retrieving (or deriving) specific data items from existing off-the-scene sources through the use of core data items recorded on-scene. A related objective was to assess the statistical significance of any difference which might occur between off-the-scene and on-scene information. The results of the study show that reliable off-scene sources exist for a number of accident investigation procedures. Areas of future research arising from this study include extensions of reliability analysis to other off-scene sources and data items, and a cost analysis of the on-scene investigation process. The results of such studies would provide essential inputs to a cost-effectiveness comparison of the present and proposed alternative method of accident data collection.

Search terms: Accident studies; Accident statistics; Accident investigation; Driver characteristics; Vehicle characteristics; Weather; Environmental factors; Light; Data analysis; Day; Night; Reliability; Statistical analysis

HS-009 380 Fld. 1/3; 1/5

A SYSTEM FOR ANALYSING
CONTRIBUTING FACTORS IN
TRAFFIC COLLISIONS

by G. M. Mackay

Published in *Technical Aspects of Road
Safety* n35 p2.1-2.30 (Sep 1968)

This paper describes some of the results from a study of urban road accidents which occurred in the city of Birmingham, England, as related to accident causation. A system of analysis has been developed which aims at describing the incidence and interaction of the various contributing factors. A multidisciplinary team studied the accident scenes, visited the hospital for social and medical data, interviewed the involved drivers at home, and examined the vehicles at garages. A system for analyzing accident contributing factors is proposed, allowing com-

found that accidents had more than one contributing factor. In the environmental area the outstanding features were inadequate sight distances and inadequate traffic control at junctions. Of vehicle deficiencies, tire pressures and treads were most significant. The most significant car design factor was forward vision restriction. The driver error factor is also considered. The overall conclusion is the interaction of many elements in accidents, involving the driver, the environment, and the vehicle.

Search terms: Accident causes; Accident investigation; Driver error caused accidents; Environmental factors; Defects; Driver errors; Accident statistics; Visibility; Skidding accidents; Sight distances; Traffic control; Brake failures; Steering system failures; Tire inflation pressure; Tire treads; Tire failures; Motorcycle accidents; Driver vehicle road interfaces; Multidisciplinary teams

HS-009 381 Fld. 1/3

SOME POTENTIAL APPLICATIONS
OF TECHNOLOGY FOR
MOTOR VEHICLE ACCIDENT INVESTIGATION

by John M. Keryeski

Cornell Aeronautical Lab., Inc.

1968 27p 5 refs
Contract FH-11-6651

Presented at the American Society of Safety Engineers Annual Conference, Lansing, Michigan, 5 Aug 1968.

The main objective of this project was to evaluate "state of the art" technology developed for other purposes to determine where it could be applied to motor vehicle accident investigation, especially in the determination of accident causation. This study was directed to examine the information requirements of accident investigation for all purposes and proposed uses. Techniques studied include: multi-level accident investigation;

2/3 Investigation (Cont'd.)

HS-009 381 (Cont'd.)

servation of accident-induced evidence at the scene.

Search terms: Accident analysis; Accident causes; Accident investigation; Multidisciplinary teams; Evidence; Interviews; Accident reconstruction; Accident research

1/4 Locations

HS-009 382 Fld. 1/4; 3/4

CAR-TRAIN COLLISIONS: GOLIATH ALWAYS WINS

by F. F. Hutcheson

Published in *Law and Order* v18 n6 p20-1, 24-5, 28-9 (June 1970)

Car-train collisions which killed an estimated 1,800 people and injured 15,000 in 14,000 grade crossing accidents in 1968 are attributed to four major causes: trains not seen; they are hard to hear; it is hard to estimate their speed and distance; and some drivers try to beat them to the crossing. Grade separations, underpasses or overpasses are the best solutions but they are very expensive. Crossing gates or flashing red lights and bells are the most practical solutions, but even they are ignored by some drivers. Even so, only about 20% of the grade crossings in the U.S. have these devices. Statistics show that one out of four persons involved in a train-car collision is killed. In all other traffic accidents, only one in thirty-five loses his life.

Search terms: Accident prevention; Railroad grade crossing accidents; Railroad grade crossing signals; Vehicle train collisions; Warning systems; Accident causes; Driver error caused accidents; Fatality rates; Accident severity

1/5 Statistical Data

RAIL-HIGHWAY GRADE CROSSING SAFETY EVALUATION. INTERIM REPORT

by Hoy A. Richards; G. Sadler Bridges; Jack T. Lamkin

Texas A & M Univ. Texas Transp. Inst.

15 Sep 1967 73p 8 refs
Report no. RR-111-1; Study-2-8-67-111

In cooperation with the Texas Highway Dept. and Bureau of Public Roads.

This report outlines the results of the work accomplished during the first year of a proposed three-year study entitled *Rail-Highway Grade Crossing Safety*. The purpose of this study is to provide the basic information necessary for the improvement of safety conditions at public rail-highway grade crossings in Texas. Tentative findings indicate that there are 13,556 public rail-highway grade crossings in the state of Texas. Of these, 1,834 (13.5%) are located on the state highway system in rural areas, 6,472 (47.7%) are on the state highways and city streets within urban areas, and 5,250 (38.7%) are on county roads. Over 78% of the Texas rail-highway grade crossings are protected only by the crossbuck device. Flashing lights, wigwags, and bells account for 17% of the crossings having protective devices while crossings protected by automatic gates represent only one percent of the Texas inventory of grade crossings. During the period 1962-1966, 1,563 rail-highway grade crossing accidents were reported to the Texas Railroad Commission. These accidents resulted in the death of 577 individuals and injury to an additional 1,685 persons. Early estimates indicate that automobile collisions with fixed objects and other automobiles at rail-highway grade crossings may be as high as 200 per year. While total vehicular injuries outnumbered total vehicular fatalities by approximately 60:1 during the 1962-1966 period, auto-train accident injuries outnumbered fatalities by less than 3 to 1. These data are indicative

Search terms: Railroad grade crossings; Accident statistics; Accident prevention; Accident analysis; Railroad grade crossing signals; Railroad grade crossing accidents; Railroad grade crossing signs; Vehicle train collisions; Warning systems; Sight distances; Regression analysis; Accident location; Accident risk forecasting; Vehicle fixed object collisions

HS-009 384 Fld. 1/5; 5/3

MOTORCYCLE ACCIDENTS, OTTAWA AREA, 1967

by E. O. Campbell; M. E. Macbeth; S. W. Ryan; Ian M. F. Arnold

Traffic Injury Res. Foundation of Canada

1968 63p 21 refs

363 motorcycle accidents were studied in the Ottawa area during 1967. 290 were legally reportable, 73 were not. Injury or death occurred in 229 accidents. 71.7% of the dead or injured were sent to hospital. Motorcycle crashes in this area are subject to seasonal influences but are quite similar to all motor vehicle accidents as to time of occurrence. The 16-25 year-old male is principally implicated as operator of the motorcycle with the 18 year-old most predominantly involved. The risk appears about 40% greater in respect to death and 120% greater in respect to injury than that encountered in all motor vehicle accidents. Hospital records for 351 motorcycle accident casualties in the Ottawa area 1967 include 180 which emanated from 363 accidents known to police and 171 from accidents unknown to police. Injuries vary greatly in respect to body area involved and severity. More than one injury occurred in 59.5% and three or more injuries in 27.6% of the victims. 81 of 657 injuries or 12.3% were classified severe or worse. Excluding face, 8.2% of all injuries were head injuries. 71.7% of all injuries in-

than unprotected riders. The psychological and sociological characteristics of motorcycle operators are described.

Search terms: Accident statistics; Motorcycle accidents; Motorcycle operator injuries; Motorcycle operator fatalities; Motorcycle safety; Injuries by body area; Age factor in accidents; Accident case reports; Accident risks; Injury severity; Adolescent drivers; Head injuries; Motorcycle passenger fatalities; Motorcycle passenger injuries; Motorcycle operator education; Arm injuries; Injuries by age; Leg injuries; Fatalities by age; Helmets; Injury case reports; Driver characteristics; Psychological factors; Male drivers; Young adult drivers

HS-009 385 Fld. 1/5; 1/2

DRIVER INJURY IN AUTOMOBILE ACCIDENTS INVOLVING CERTAIN CAR MODELS

by B. J. Campbell

North Carolina Univ. Highway Safety Res. Center

Jul 1970 132p

This study deals with the variation in injury to unbelted drivers involved in crashes while driving various car makes and models. Data were extracted from a pool of reports on 270,000 vehicles involved in crashes in North Carolina in 1966 and 1968. Driver injury in each car make was compared to driver injury in the aggregate of all vehicles, and the comparisons were made on the basis of a set of crash circumstances, similar as to speed, impact site, and accident type. Index scores for many make-year combinations were calculated. It was found that indices ranged among car models from 50 or less (half as frequent injury as in the aggregate) up to 200 or more (twice as frequent injury as in the aggregate). Injury values tended (as would be expected) to be less frequent among heavier cars and more frequent

quent among later model cars and more frequent among earlier model cars.

Search terms: Statistical analysis; Driver injuries; Injuries by vehicle age; Injuries by vehicle model; Injuries by vehicle make; Injuries by vehicle size; Impact angle; Injuries by accident type; Accident statistics; Injury statistics; Automobile models; Vehicle weight; Vehicle age; Vehicle size; Injury severity index; Seat belt usage

HS-009 386 Fld. 1/5; 1/3

CAUSES AND CHARACTERISTICS OF SINGLE CAR ACCIDENTS. PT. 1

by Hugh S. Penn

California Dept. of Highway Patrol

Feb 1963 34p

The single car accident as a proportion of all accidents has increased during the years 1950-61. It now makes up about 40% of fatal and injury accidents. The five major causes of single car crashes are speed, drowsiness, drinking or drugs, faulty driving, and mechanical failure. A comparison of driving performances indicates that women are somewhat safer motor vehicle operators than are men. Men tend to become involved in accidents through disregard of safe driving principles, while women do so largely because of lack of manipulative skill. Analysis of drivers' age in relation to accidents shows the 15-24 year group is outstandingly dangerous. The driver who is alone in his vehicle seems to run a greater risk of single car crash. Most single car crashes occur in the early hours of the morning. Rashness and inattention were found to be common accident factors. The greatest proportions of fatalities and serious injuries are produced by speed, drinking and drowsiness. Ejection of the victim compounds the gravity of crash injuries.

Search terms: Accident analysis;

Accident severity; Sex factors in accidents; Age factor in accidents; Ejection causes injuries; Accident factors; Single vehicle accidents; Accident risks; Time of accidents; Injury severity

HS-009 387 Fld. 1/5

CAUSES AND CHARACTERISTICS OF SINGLE CAR ACCIDENTS. PT. 2

by Hugh S. Penn

California Dept. of Highway Patrol

Oct 1964 40p

Prepared in cooperation with Bureau of Public Roads.

Relationships among accidents, marital status, police contacts, credit ratings, estimated annual mileage, traffic convictions, occupation, and reason for not completing the driver attitude survey are discussed. This study is based on the records of adult male subjects. The variables which showed significant differences between the control group and the study group were all the relationships listed above except occupation. The case study technique was applied to two fatal accident drivers selected in the experimental sample. It appears that accident-involved subjects came from lower socio-economic strata than control subjects. In general, the analysis of biographical items can identify driver groups with greater than average likelihood of incurring accidents, but is not precise enough to pinpoint individual accident-susceptible drivers.

Search terms: Accident causes; Convictions; Driver social class; Marital status; Driver mileage; Driver behavior; Driver occupation; Driver attitude measurement; Accident rates; Accident proneness; Single vehicle accidents; Male drivers; Adult drivers; Driver records; Problem drivers; Credit

HS-009 388 Fld. 1/5

ANALYSIS OF MOTOR CARRIER ACCIDENTS INVOLVING FIRE, 1959-1962

Bureau of Motor Carriers

Jun 1964 94p

Truck fire accidents comprised less than 3% of reported accidents, but produced a disproportionately large percentage of total deaths and property damage. Although fire accidents comprised less than one-half of 1% of reported bus accidents each year, they produced up to 4% of all deaths, and up to 13% of total property damage. A very large majority of bus fire accidents involved fire-only (not preceding collision or overturn). Such fire-only accidents ranged from a high of 95% of all fire accidents in 1959 to a low of 77% in 1962. Carriers of property reported a total of \$25,332,200 property damage caused by 2,691 fire accidents in the four-year period, 1959-1962, at an average cost of \$9,414 per accident.

Search terms: Accident caused fires; Accident severity; Truck accidents; Bus accidents; Property damage accidents; Tire fires; Accident causes; Vehicle fires; Accident costs; Fuel systems failures; Accident statistics; Motor carriers; Fatalities; Injury statistics; Accident analysis

HS-009 389 Fld. 1/5

PERSONS INJURED AND DISABILITY DAYS DUE TO INJURY, UNITED STATES, JULY, 1965-JUNE, 1967

by George V. Graham

Health Services and Mental Health Administration

Published in *National Center for Health Statistics* Ser 10 n58 p1-72 (Mar 1970)

78p
Report no. PHS-Pub-1000

Vital and health statistics: data from the National Health Survey.

Statistics on the incidence of persons injured and associated disability by class of accident, place of accident, and selected demographic characteristics of the population are given, based on data collected in household interviews during the period July 1965 to June 1967. The statistics include motor vehicle accidents, work accidents, home accidents, and "other," comprising various smaller statistical groups. The data analysis includes age, sex, and income groups of accident victims.

Search terms: Accident statistics; Statistical analysis; Injuries by accident type; Accident analysis; Age factor in accidents; Injuries by age; Sex factors in accidents; Socio-economic data; Vehicle accidents; Industrial accidents; Accident types

HS-009 390 Fld. 1/5; 1/3

CONTRIBUTION OF INCREASED CRASH SPEEDS TO MOTOR VEHICLE FATALITIES IN VIRGINIA, 1961-1967

by Eugene E. Lunn; Donald F. Mela

National Highway Safety Bureau

1969 19p 1 ref

Using 1961 as the base year, data on crashes, speed, and fatal crash involvement of drivers were examined. It was concluded that the increasing proportion of high speed crashes was a major contributing factor in the growth of motor vehicle deaths in Virginia for the years 1961-1967, accounting for over one-half of the increase in driver fatal involvements. Data are presented in tables, graphs, and charts.

Search terms: Fatality rates; Virginia; Speed; Accident statistics

AVAILABILITY: A reference copy only in NHTSA Technical Reference Div.; no copies available for distribution

HS-009 391 Fld. 1/5; 2/4; 1/4

GENERAL DESIGN

by Robert F. Dawson; Joseph C. Oppenlander

Highway Users Federation for Safety and Mobility

1971 16p 37 refs

Ch. 11 of *Traffic Control and Roadway Elements - Their Relationship To Highway Safety*. Revised

Geometric design and general location of highways interact with various driver, vehicle, traffic, environmental, and other roadway factors to affect accident frequency, severity, and type. Although accident rates are higher in urban areas, rural areas reflect greater accident severity. In addition, highway systems in the local and secondary classifications generally have the highest accident rates and direct accident costs per vehicle mile of travel. Safety advantages of access control have been demonstrated in many studies; the greatest benefits are in urban areas. Minor highway improvements such as signing show significant reductions in accident rates, especially when constructed to correct hazardous locations.

Search terms: Highway design; Highway location; Accident rates; Accident severity; Urban accidents; Rural accidents; Access control; Highway improvements; Driver vehicle road interfaces; Accident types; Accident statistics; Accident costs; Vehicle mileage; Safety design; Fatality rates; Injury rates

HS-009 392 Fld. 1/5; 2/4

ALINEMENT

Leisch (Jack E.) & Associates; Highway Users Federation for Safety and Mobility

1971 21p 99 refs

Ch. 12 of *Traffic Control and Roadway Elements - Their Relationship To Highway Safety*. Revised

Most studies have concluded that curvature is strongly related to accidents with significant increases in accidents for curvature over 8 degrees. In addition, there is evidence that curve frequency is a critical factor, in that the introduction of relatively sharp curves in a section on which curves are infrequent increases the accident potential. When existing sharp curves are improved through reconstruction, the number of accidents and their severity can be reduced. It is concluded that vertical alignment is related to safety, especially steeper grades. Eleven tables are included, relating accident rates to various aspects of curvature and gradient.

Search terms: Road curves; Road grades; Accident rates; Highway improvements; Highway accident potential; Accident statistics; Accident prevention; Accident severity; Alignment

HS-009 393 Fld. 1/5; 3/4; 3/1

TRAFFIC DEATH AND SUICIDE. A STATISTICAL STUDY

by Frank A. Haight

California Univ. ITTE

1965 40p 24 refs

Prepared for presentation at 7th Western Divisional meeting of the American Psychiatric Assoc., Honolulu, 28 Aug - 9 Sept 1965.

An attempt is made to establish a connection between traffic deaths and suicide. Three types of traffic accidents are identified as being of possible suicidal intent: (1) falling asleep at the wheel; (2) wrong way driving; (3) persons with high alcoholic content in their blood. The role of alcohol in the final act has been discussed by many writers on suicide.

Accident rates; Drinking drivers; Wrong way driving; Accident statistics; Statistical analysis

2/0 HIGHWAY SAFETY

HS-009 394 Fld. 2/0

THE NATIONAL HIGHWAY SAFETY PROGRAM: A LABEL OR A REALITY?

by Alfred F. Lynch; Ben A. Jordan

Published in *Traffic Digest and Review*
v18 n12 p1-5 (Dec 1970)

3 refs

The national highway safety program became a reality in 1966 when Congress passed the Highway Safety Act. Experience has shown that a coordinated traffic records system is needed to implement the act. The Highway Safety Act provides matching funds and grants to help states meet its provisions. Most states were not ready to answer the questions: what should be included in traffic record data and what standards should be automated first. Georgia with the help of outside consultants studied the problem and came up with some recommendations: better understanding and planning of long range projects, better coordination among departments in developing the required information systems and cognizant federal agencies should be directed to provide meaningful guidance to the states.

Search terms: Highway safety programs; Automated accident records; Georgia; Traffic records; Federal state relationships; Highway Safety Act of 1966

2/2 Communications

TION OF EMERGENCY ROAD- SIDE TELEPHONES

by J. Edwin Clark; L. Ray Johnson

Published in *Traffic Engineering* v41 n1
p50-2, 54-6 (Oct 1970)

In a study of traffic deaths in rural areas, it is suggested that the time from the accident occurrence to the time of accident notification is a critical factor, and that delay may explain the reasons for the higher mortality noted in certain rural areas. Roadside telephones could provide a valuable link in the communications network by reducing the time required for notification of accidents. Roadside emergency telephones were installed on a fifty-nine mile section of rural highway in Mississippi as part of a fifteen month emergency medical care study. Their usage is discussed and compared with a simulation model.

Search terms: Time factors; Emergency services; Emergency reporting systems; Rural highways; Roadside telephones; Systems analysis; Evaluation; Simulation models

2/4 Design and Construction

HS-009 396 Fld. 2/4

DRAGNET VEHICLE ARREST- ING SYSTEM

by Gordon G. Hayes; T. J. Hirsch; Don L. Ivey

Published in *Highway Research Record*
n306 p39-49 (1970)

The "dragnet" vehicle arresting system consists of a net made of steel cables attached at each end to Metal Bender energy-absorbing devices. The system was subjected to six full-scale automobile crash tests to evaluate its performance in stopping a speeding vehicle.

2/4 Design and Construction (Cont'd.)

HS-009 396 (Cont'd.)

rigid barriers, and could have been reduced even more by the use of less restraining force on the net, resulting in longer stopping distances. Time-displacement and deceleration data (and observation of damage) from the test series, along with the predictability of system performance in specified situations, indicate that practical application of the arresting system at such locations as dead ends of roads, ferry landings, and highway medians at bridge overpasses is feasible.

Search terms: Barrier collision tests; Nets; Deceleration tests; Energy absorbing barriers; Stopping distance

HS-009 397 Fld. 2/4

FEASIBILITY OF LIGHTWEIGHT CELLULAR CONCRETE FOR VEHICLE CRASH CUSHIONS

by Don L. Ivey; Eugene Butth; T. J. Hirsch

Texas A & M Univ. Texas Transp. Inst.

Published in *Highway Research Record*
n306 p50-7 (1970)

3 refs

Three vehicle crash tests of lightweight cellular concrete crash cushions are reported, along with proposed procedures for cast-on-place and pre-cast construction of these devices. This crash cushion, composed of vermiculite concrete, lightweight welded wire fabric, and cylindrical cardboard forms, is designed to protect motorists from collisions with rigid obstacles located along the roadway. The crash cushion has proved crash-

HS-009 398 Fld. 2/4

LOCKED WHEEL FRICTION TESTS ON WET PAVEMENTS

by William Close

Cornell Aeronautical Lab., Inc.

1961 47p 4 refs

Prepared for presentation at the 40th annual meeting of the Highway Research Board, Washington, D.C., 11 Jan 1961.

The friction coefficient between a pair of locked automotive tires (running in the normal wheel tracks) and a wet highway surface was determined in an elaborate test program, using a specially constructed test trailer. This program provided data from over 400 tested surfaces along approximately 6,500 miles of rural sections of major transcontinental routes following the National System of Interstate and Defense Highways as nearly as possible. The data are tabulated, and cross-plots have been made to indicate the effects of age, wear (based on age and traffic volume), surface finish, and aggregate composition on the friction coefficient exhibited by portland cement concrete roads. Summaries are made also for the comparative effects of age and wear on the friction coefficients of PCC and bituminous asphalt roads.

Search terms: Wheel locking friction; Wet road conditions; Statistical analysis; Road surfaces; Portland cements; Pavement friction; Bituminous concrete pavements; Pavement skidding characteristics; Coefficient of friction; Pavement wear; Pavement surface texture; Surface friction; Friction tests

Highway Users Federation For Safety and Mobility

Mar 1970 71p

Many highway maintenance organizations today recognize a need to develop an awareness in all personnel: 1) That many highway defects pose an undesirable potential threat or hazard to the unwary motorist; i.e., pavement deficiencies, including slippery surfaces, pavement drop-offs, low shoulders, poor drainage and trapped water, blind intersections, dirty or obscured signs, improper pavement markings, etc.; 2) That prompt identification and repair of these highway faults through sound maintenance programs can improve highway safety and save money; 3) That utilization of proper safety devices to alert, warn, and direct traffic through or around maintenance sites can safeguard the lives of motorists and maintenance men; and, 4) That safety of the driving public must be uppermost in the minds of all maintenance employees. Toward these ends, this pocket handbook has been developed. It presents illustration and narrative examples of roadway hazards and scenes of good and bad maintenance operations. It is intended as a reference guide for maintenance crews.

Search terms: Highway maintenance; Highway safety; Pavement damage; Skidding; Pavement markings; Snow removal; Ice removal; Slopes; Roadside hazards; Pavement skidding characteristics; Highway signs; Sign dirt accumulation; Roadside maintenance; Drainage; Road shoulders; Safety devices; Construction site traffic control; Guardrail design; Highway improvements; Highway accident potential

2/7 Meteorological Conditions

HS-009 400 Fld. 2/7; 2/4

2/6 Maintenance

Published in *Highway Research Record* n311 p1-9 (1970)

Results obtained in a theoretical study of phenomena encountered when an automotive tire rolls or skids on a pavement covered with a water film are discussed. The analysis is based on a mathematical model in which the flow is divided into a footprint region, an inlet region forward of the footprint region where the gap between the tire and the pavement is comparatively large, and an exterior flow region. In partial hydroplaning, a thick fluid film penetrates between the tire and pavement over a portion of the footprint while "semidry contact" is assumed to exist in the remainder of the footprint. The flow through the semidry portion of the footprint is analyzed using effective film thicknesses based on pavement drainage characteristics. It is found that in some cases three dimensional flow effects appreciably lower the lift coefficients developed by hydroplaning tires.

Search terms: Hydroplaning; Mathematical models; Skidding; Wet road conditions; Tire pavement interface; Tire prints; Coefficient of friction

2/8 Police Traffic Services

HS-009 401 Fld. 2/8

PINPOINTING THE PROBLEM DRIVER IS BUT ONE PHASE OF THE ARKANSAS STATE POLICE TRAFFIC PROGRAM

by Ralph D. Scott

Published in *Law and Order* v18 n6 (June 1970)

Police traffic services in relation to a traffic safety program are described.

Search terms: Problem drivers; Police traffic services; Arkansas; Speed control; Driver intoxication; Traffic law

2/9 Traffic Control

HS-009 402 Fld. 2/9

SIGN LANGUAGE HAS BRITAIN EVOLVED AN EFFECTIVE ROAD-SIGN SYSTEM?

by Bruce Main-Smith

Published in *Autocar* v132 n3873 p2-5 (7 May 1970)

Since the 1930 Road Traffic Act the main factors working on the evolution of the present British sign-language system have been several committees, domestic and foreign. The present system mainly adheres to the recommendations given by the Worboys Committee. However, the signs are totally at variance with Continental practice and the assumptions of the Worboys Committee might not be valid anymore. Psychologically and economically there is a need for improvement. Photographs of present British road signs are included.

Search terms: Traffic signs; Highway signs; Photographs; Sign standards; Great Britain; Sign history; Sign uniformity

HS-009 403 Fld. 2/9

A VIEW FROM THE SKY

Anonymous

Published in *Air Force Driver* v3 n12 p6-11 (May 1970)

A small airplane is used to check out traffic problems in the San Bernardino-Riverside, California, area. Driving mistakes most often observed from the air are discussed. Tailgating, lane changing, driving too slowly or too fast, and driving incautiously in bad weather conditions are frequently seen.

Search terms: Aerial surveillance; Traffic surveillance; Driver errors; Tailgating; Lane changing; Driver behavior;

HS-009 404 Fld. 2/9; 5/4

SAFETY CONSIDERATIONS FOR A HIGH DENSITY AUTOMATED VEHICLE SYSTEM

by Michael Lenard

Published in *Transportation Science* v4 n2 p138-58 (May 1970)

18 refs

Simulation on the digital computer was used to evaluate systems safety for high-density traffic of automatically controlled vehicles. The response of vehicle-borne and wayside emergency control systems to sudden failure of a moving vehicle and failure to detect a stalled vehicle ahead was investigated. The number and severity of the resulting collisions were used as measures of the system's ability to cope with accidents. The capacity and safety performance of the wayside control system were found to be distinctly superior to that of the vehicle-borne system. For a desired lane capacity, the most reasonable operating speed depends primarily on vehicle length. Finally, the results indicate that significant (systems') safety benefits are obtained if vehicles are able to maintain their speedy movement for a short time after a collision.

Search terms: Failures; Automatic control; Control equipment; Disabled vehicles; Traffic models; Accident avoidance; Traffic density; Automatic vehicles; Vehicle control; Computerized simulation; Automatic headway control; Guidance systems; Simulation models; Speed patterns; Distance headways; Accident rates; Accident severity index

HS-009 405 Fld. 2/9; 4/7

TESTING OF THE IN-THE-FIELD ACCURACY OF THE VASCAR AND TDS SPEED DETECTION DEVICES

2/9 Traffic Control (Cont'd.)**HS-009 405 (Cont'd.)**

North Carolina Univ. Hwy. Safety Res. Center

Aug 1970 17p

Recently a new speed detection device, the TDS speed computer, has been offered to the state of North Carolina for use. This report concerns comparative field testing of this TDS unit and the VASCAR unit, the speed computer used by the North Carolina State Highway Patrol since 1967. Two operators clocked a target vehicle five times in each of five basic maneuvers with each of the two units. Analysis of this data indicated that there is not statistically significant difference between the error medians of the devices, and no statistically significant differences between the two devices in the higher quartile or decile of the error population. The data seem to indicate that the TDS errors may vary more from the median error than do the errors of the VASCAR, but not to a significant degree. The results of this limited field testing seem to indicate that both the TDS and VASCAR speed computers are accurate devices when properly used.

Search terms: Speed computers; Speed studies; Visual Average Speed Computer and Recorder; Speed patterns; Errors; Statistical analysis; Data analysis; Target detection; Tracking

HS-009 406 Fid. 2/9

TRAFFIC OPERATION SPEED STUDIES. SEMI ANNUAL SPEED STUDIES

Arizona Highway Dept.

Mar 1965 59p

The Statewide Traffic Operation Study is conducted semi-annually to provide current data on the speeds of vehicles on major highways. Day and night speed studies were taken at fifteen permanent stations in the State. Maximum day speed zoning is 70 mph, and maximum night speed zoning is 65 mph at the present time. Day to night speed comparisons are shown graphically.

Search terms: Speed studies; Speed patterns; Day vs night speeds

2/10 Traffic Courts

HS-009 407 Fid. 2/10; 4/1

THE SCOFFLAW. A REPORT ON HOW COOK COUNTY, ILLINOIS COLLECTED ITS OVERDUE PARKING TICKETS. A PROFILE ON THE HABITUAL PARKING VIOLATOR

by Matthew J. Danaher

Cook County Circuit Court, Ill.

1970 9p

In mid 1969, the newly-elected Clerk of the Circuit Court, Matthew J. Danaher, proposed a program to collect overdue parking tickets. The program, called Scofflaw Court, would have several beneficial results: It would clear the court's books of thousands of tickets. It would aid in the city's fight against traffic congestion because illegally parked cars constitute a traffic hazard. It would help renew citizen faith in the judicial and law enforcement system. It would produce substantial new income. This is a report on the results of the Scofflaw Court and what they can mean for other cities in the country.

Search terms: Parking regulations; Traffic law violations; Traffic ticket systems; Traffic law enforcement; Traffic law violators; Driver charac-

3/0 HUMAN FACTORS**3/1 Alcohol**

HS-009 408 Fid. 3/1

HEAVY DRINKERS ARRESTED FOR "DRIVING UNDER INFLUENCE"

Anonymous

Published in *Highway Safety Research Center Bulletin* n13 p1-2 (Jul 1970)

Two studies of blood alcohol levels were made of North Carolina motorists and it was concluded that heavily intoxicated motorists are those who contribute to highway accidents.

Search terms: Drinking drivers; Breathalyzers; Blood alcohol levels; Driver intoxication

HS-009 409 Fid. 3/1

WHO'S AT FAULT IN MIS-HANDLED DWI CASES

by Royal A. Neilson

Published in *Traffic Safety* v70 n12 p8-10, 40 (Dec 1970)

In a summary of criticisms leveled at mishandled driving-while-intoxicated cases the prosecutor, police, expert witnesses and court system all share the blame. The prosecution is criticized for using inexperienced deputies with little knowledge on how to prove drunkenness, for paying too much attention to public opinion, or inadequately preparing the case. The police are criticized for wanting to be prosecutor, judge and jury all in one, of being too eager or too reluctant to go to court, depending on the case, or failing to attend properly to paper work. The expert witness is faulted for his often condescending manner or for talking over the jury's head. Finally, although the court should reflect the dignity of the law of the land,

JULY 30, 1971

HUMAN FACTORS

the electorate after running unopposed. In some cases, the judges' own personal habits may affect the jury's decision or the lawyer's handling of the case.

Search terms: Drinking drivers; Court decisions; Police law enforcement responsibilities; Witnesses; Testimony

HS-009 410 Fld. 3/1

ALLSTATE CAMPAIGN RESULTS IN GRASS ROOTS ACTION ON THE DRUNK DRIVER MENACE

by Robert Leys

Published in *Traffic Digest and Review* v18 n5 p1-5 (May 1970)

The Allstate campaign has been carried to the people since December, 1968, through public service advertising in national magazines, newspapers and on television. The direct public response to this advertising, often in the form of personal correspondence with the company, has underlined the success of this approach in really reaching the people on this issue. Objectives of the campaign are: 1) Stimulate effective public and private action to help stop the drunk driver traffic slaughter; 2) Promote the adoption (by states which lacked them) of an implied consent law and a chemical test law with 0.10% alcohol concentration in the blood as the presumptive level of intoxication; 3) Ultimately, to lower auto insurance premiums for policyholders by reducing alcohol-related auto crashes. Allstate's strategy aims to build strong support among the general public, business and industry, and in the legislatures and executive offices of the states for the alcohol standard.

HS-009 411 Fld. 3/1

BLOOD ALCOHOL AND HIGHWAY ACCIDENTS

by William Y. Howell; James E. Wilson

Published in *Traffic Engineering* v41 n1 p12-5, 17 (Oct 1970)

Present methods of dealing with the drinking driver in Great Britain and Sweden are discussed. Little if any effort in the United States is directed at keeping the known problem drinker from behind the wheel or regulating his driving behavior before he causes an accident. Deficiencies in the present approach are discussed.

Search terms: Alcohol usage; Drinking driver evidence; Drinking drivers; Great Britain; Sweden; United States; Blood alcohol levels; Alcohol laws; Alcohol usage deterrents; Driver intoxication; Alcoholism

HS-009 412 Fld. 3/1

RECOGNIZING THE DRINKING DRIVER

by Charles A. Rosenblatt

Published in *HIT LAB Reports* p1-4 (May 1971)

This study examines a group of 1,247 hospitalized alcoholics who operated a motor vehicle from 1961 to 1967. The study demonstrates that problem drinking drivers are frequently rather young drinkers who have a high rate of driving convictions. Since this group is not normally identified and treated as alcoholics, the study discusses the policy implications of this finding.

3/3 Cyclists

HS-009 413 Fld. 3/3; 3/4

ADVICE TO MOTORCYCLISTS: "MAKE YOURSELF MORE VISIBLE"

Anonymous

Published in *Highway Safety Research Center Bulletin* n13 p2-4 (Jul 1970)

In a recent study it was found that many motorcycle accidents occur because of the failure of the motorcyclist to make himself visible to other drivers. Suggestions are made as to how these accidents may be avoided including special testing of the operator's ability to handle his motorcycle.

Search terms: Motorcycle safety; Motorcycle visibility; Accident prevention; Driver skills

3/4 Driver Behavior

HS-009 414 Fld. 3/4

INCREASE IN TRAFFIC KNOWLEDGE. FURTHER RESEARCH ON KNOWLEDGE OF TRAFFIC REGULATIONS AND SIGNS

by Lisaa Oranen

Central Organisation for Traffic Safety in Finland

Published in *Reports from TALJA* n10 p33-43 (1970)

The original reports were published in Finnish in *Taljan Tutkimuksia* n2, 1965; n18, 1969.

This study is part of a series of investigations started by TALJA in 1963 to

3/4 Driver Behavior (Cont'd.)**HS-009 414 (Cont'd.)**

between individual questions on one hand, and between the drivers of the different vehicle groups on the other in the amount of correct answers. A remarkable increase in the knowledge of certain questions and certain vehicle groups has taken place, but as far as security of traffic is concerned it might be useful to make a more comprehensive study of the problem. In further investigations, the questions should be more difficult so as to obtain a greater fluctuation between the various groups. In that way training could be adapted to the special problems of each group.

Search terms: Traffic signs; Traffic signal regulations; Traffic signal effectiveness; Traffic laws; Driver interviews; Driver experience; Driver characteristics; Professional drivers; Driver mileage

HS-009 415 Fld. 3/4; 1/3**CAUSES AND CHARACTERISTICS OF SINGLE CAR ACCIDENTS. PTS. 3 AND 4**

by Hugh S. Penn

California Dept. of Highway Patrol

Jan 1965 25p 26 refs

The first follow-up report, dated Nov 1966, is HS-002 706. Prepared in cooperation with Bureau of Public Roads.

Comparison is made between results of biographical item treatment and psychological testing of subject drivers, with substantial agreement in the results obtained through the two approaches. The accident potential of men and women was found to be much the same. Juvenile male drivers were found to have a very high violation tendency as compared to male drivers. Accident

inferred. The accident process is seen as a driver breakdown in performance, generally temporary, except in two groups: those who lack the capacity for successful driving and those subject to persistent psychological and emotional disturbances. Variables which show the greatest power to discriminate between accident susceptible and less susceptible drivers are described, and their use in identifying drivers who are bad risks is discussed.

Search terms: Accident causes; Accident analysis; Driver attitude measurement; Driver age; Accident records; Driver sex; Psychological tests; Driver behavior research; Accident risk forecasting; Problem drivers; Adolescent drivers; Accident rates; Driver mental fitness; Psychological factors; Accident proneness; Single vehicle accidents; Male drivers; Female drivers

HS-009 416 Fld. 3/4; 3/12**THE IMPORTANCE OF DRIVER LIMITATIONS IN VEHICLE CONTROL**

by A. Irving; T. S. Bowles

Institution of Mechanical Engineers (England)

1968 8p 22 refs
Report no. Paper-10

Presented at Symposium on Vehicle and Road Design for Safety, Cranfield, 3-4 Jul 1968, jointly sponsored by the Institution of Mechanical Engineers and the Advanced School of Automobile Engineering.

Rapid advances in the performance of motor vehicles has emphasized the limitations on the abilities of drivers. Attempts to define and measure abilities relevant to driving tasks are illustrated with reference to perception of speed, decision making, and tests of basic visual abilities. Some of the special problems of

relevant to driving justify further extensive research effort.

Search terms: Risk acceptance; Psychological factors; Speed patterns; Visual acuity; Driving tasks; Driver behavior; Perception; Decision making; Vision; Velocity perception

HS-009 417 Fld. 3/4**AN INVESTIGATION OF THE PROBLEMS AND OPINIONS OF AGED DRIVERS**

by Thomas W. Planek; Margaret E. Condon; Richard C. Fowler

National Safety Council

Dec 1968 250p 141 refs
Report no. PB-187 673; RR-5/68

This report contains: (1) An up-to-date review of the literature on aging and the aged driver, (2) An analysis of questionnaire results covering facts about the aged driver, his driving experience, opinions on various aspects of the driving task and knowledge of rules of the road, (3) A profile of the aged driver problems derived from an analysis of traffic accident records and the results of questionnaire items.

Search terms: Aged drivers; Driver experience; Accident records; Driver characteristics; Driver mileage; Questionnaires; Driving tasks; Driver licensing; Driver physical fitness; Driver statistics; Accident risks; Accident rates; Age factors in driving

AVAILABILITY: NTIS

HS-009 418 Fld. 3/4; 4/1**CONTROLLING DRIVER BEHAVIOR BY MEANS OF LEGAL SANCTIONS**

by Roger G. Crumley

Presented at Second Annual Auto Insurance Industry Traffic Safety Research Symposium, 19-21 March 1968.

This paper considers first the general understanding of legal scholars and criminologists with respect to the deterrent effect of legal sanctions; a second part summarizes current knowledge concerning the effects of legal sanctions in controlling driver behavior; and a concluding section discusses briefly the methods available for the development of needed new knowledge.

Search terms: Driver behavior; Traffic law violations; Traffic law enforcement; Penalties; Accident studies; Driver intoxication; Driver improvement schools; Driving without a license; Research methods; Driver improvement; Crime prevention; Problem drivers; Insurance rates; Parking regulations; Driver rehabilitation

HS-009 419 Fld. 3/4; 3/5

EFFECTIVENESS OF INDIVIDUAL AND GROUP DRIVER IMPROVEMENT INTERVIEWS

by Peggy Ann O'Neill; Kenny McKnight

Washington Dept. of Motor Vehicles

Jul 1970 14p
Report no. 027

The purpose of this research is to evaluate the effectiveness of the individual and group driver improvement interviews as tools in reducing the frequency of subsequent violations and accidents. Two experimental groups and a control group were studied: 1) a group of drivers who were administered individual interviews. 2) a group of drivers who were administered group interviews. 3) a control group who were called in but told the interview was cancelled due to illness of the driver improvement analyst. After three months the drivers' records were analyzed and the investigators found out that the treatment in the form of a notice to appear, apprehension

before the interview date, and appearance for the interview may be as effective as the interview. Another study is needed to determine whether or not the drivers who appear and are administered an interview are more or less likely to accumulate additional violations or accidents in more or less time as compared to comparable drivers uncontacted.

Search terms: Driver behavior; Driver behavior research; Driver counseling; Driver improvement; Driver improvement measurement; Driver performance; Driver statistics; Traffic law violation forecasting; Driver interviews; Driver records; Problem drivers; Accident rates

HS-009 420 Fld. 3/4

SYSTEM ANALYSIS PINPOINTS DRIVER TASK

by A. James McKnight

Published in *Traffic Safety* v70 n12
p16-7, 35-6 (Dec 1970)

A systems analysis approach used to define the demands made on the driver by the highway transportation system is described. After breaking down the drivers' tasks to component behaviors, each behavior was ranked as to criticality from accident reports on file at the National Highway Safety Bureau and Cornell Aeronautical Laboratory.

Search terms: Driver behavior research; Systems analysis; Driving task analysis; Accident risk forecasting

3/5 Driver Education

HS-009 421 Fld. 3/5

THINGS THEY DON'T TEACH IN DRIVER ED!

by Michael Lamm

Published in *Popular Mechanics* v134 n5
p97-9, 210, 212, 214 (Nov 1970)

One of the fallacies of driver education programs is that they seldom include skid control. The University of Nevada offers an extension course on that subject. The skid school main function is to teach any driver how to prevent and control an emergency skid. The course consists of six hours of instruction: understeer and oversteer, loss of control, regaining control, slides and slide correction.

Search terms: Driver education; Skid control; Understeer; Oversteer; Loss of control; Vehicle control; Skid pans

HS-009 422 Fld. 3/5

HOW GOOD ARE DRIVER EDUCATION TEACHING ASSISTANTS?

by Kenneth F. Licht

Published in *Traffic Safety* v70 n6 p8-11
(Jun 1970)

At the time of passage of the Highway Safety Act of 1966, Texas was providing driver education to only 32% of its eligible youth. The state board of education approved a plan to use non-degree personnel as teaching assistants in the state's driver education program. The program appears to be very successful at a considerable saving and indicates that other than degree personnel having love, respect, and dedication to duty may excel in teaching when properly supervised.

Search terms: Driver education evaluation; Instructors; High school driving courses; Texas

3/6 Driver Licensing

HS-009 423 Fld. 3/6

AN EVALUATION OF WASHINGTON'S AUTOMATED DRIVER KNOWLEDGE EXAMINATION

OTHER SAFETY RELATED AREAS

HSL No. 71-21

3/6 Driver Licensing (Cont'd.)

HS-009 423 (Cont'd.)

by Steve Paulsruide; Peggy Ann O'Neill

Washington Dept. of Motor Vehicles

Jul 1970 29p
Report no. 029

This study was an evaluation of the test results obtained from 262 subjects taking Washington's new automated driver license knowledge examination. The carousel slide projectors presenting the examination to the study subjects held 81 items, and the system was designed so that each study subject would take, at random from this item pool, a balanced series of 27 items, 25 of which were rules of the road, situational analysis, and defensive driving questions (in the future, these 25 items are referred to as the knowledge test). The two additional questions were road sign identification items. It was concluded that the examination in its entirety is difficult to pass, but that it is an effective testing approach.

Search terms: Driver license examination; Driver tests; Driving simulation; Sign recognition; Defensive driving; Traffic laws

4/0 OTHER SAFETY-RELATED AREAS

4/1 Codes and Laws

HS-009 424 Fld. 4/1

THE ILLINOIS VEHICLE CODE AS AMENDED, EFFECTIVE JULY 1, 1970

by Paul Powell

Illinois Office of the Secretary of State

reference for all aspects in one publication. The Code is in compliance with federal standards and the uniform vehicle code.

Search terms: Law uniformity; Vehicle laws; Illinois; Traffic laws; State laws; Driver license laws; Safety laws; Inspection laws; Insurance laws; Motor carriers; Liability; Vehicle registration; Traffic law enforcement

4/5 Information Technology

HS-009 425 Fld. 4/5; 4/8

OBSTRUCTION DETECTION PROGRAM. FINAL REPORT

15 Mar 1969 165p
Contract 7-35509
Report no. PB-182 996

The goal of this program was to determine laser techniques for obstruction detection on high speed ground transportation guideways and to verify operational performance principles with a validation model of a preferred equipment configuration. An obstacle detection system comprised of transmitters and collocated receivers spaced alongside railroad tracks and scanning across the tracks to a continuous retroreflective fence was studied, tested, and demonstrated. The transmitters emit a very narrow beam of collimated coherent light from a gallium arsenide laser. The retroreflector establishes a narrow region with reflectivity substantially higher than the normal surroundings. An object located between the laser transmitter and the retroreflector will prevent the laser beam from impinging upon the retroreflector and will, therefore, cause a variation in the return energy normally observed by the receiver. This variation is then reported to a central station for further action.

flex reflectors; Foreign objects; Railroad tracks

AVAILABILITY: NTIS

4/6 Insurance

HS-009 426 Fld. 4/6

STATE PLANS—NEW YORK. FUNDAMENTAL CHANGE—NO PATCHWORK

by Richard E. Stewart

Published in *Trial* v6 n6 p12, 19-20 (Oct-Nov 1970)

The insurance business has given little attention to whether a certain adjuster was agreeing to pay claimants too little or too much — as long as the adjuster filled out all forms properly. That tradition of indifference is now changing, however, as indicated by the New York Insurance Department report submitted to Governor Rockefeller last February. The report, entitled "Automobile Insurance . . . For Whose Benefit?" reviews at length the record of the present fault system in handling costs of automobile accidents. It is recommended that the fault system be abandoned and replaced by compulsory insurance not based on fault and negligence.

Search terms: Insurance claims; Fault; Accident compensation; Accident costs; Compulsory insurance; Negligence; Liability insurance; No fault insurance plan

HS-009 427 Fld. 4/6

HAZARDS, PITFALLS, EXPENSES

by Donald W. Segraves

system is: How would it work out in practice? How would the proposed new system affect the underwriting and claims handling functions? Which groups of drivers would be regarded as more, or less, desirable customers from the standpoint of loss exposure? What new considerations would become pertinent in raising or lowering auto insurance prices for particular groups and individuals? The staff of the American Mutual Insurance Alliance asked a group of claimsmen and group of underwriters to assess Governor Rockefeller's proposed new non-fault system from an operational point of view. Included are the questions they raised and the observations they offered.

Search terms: Insurance costs; Insurance claims; Insurance rates; No fault insurance plan

HS-009 428 Fld. 4/6

WHAT'S REALLY BEHIND THE AUTO INSURANCE RATE INCREASES?

by George F. Reed

Published in *Journal of American Insurance* v46 n3 p20-5 (May-Jun 1970)

The automobile insurance-buying public is today exposed to a confusing dilemma because of a continuing spiral of insurance premiums and an increasing difficulty in obtaining or maintaining automobile insurance. All of this comes, ironically, at a time when the indispensability of such coverage has never been more widely appreciated. Simply stated, insurance rates are up because the number of accidents has increased, the number of people killed or injured has increased, the dollar value of property damage has also increased. The cost of these accidents to insurance companies has doubled. Drivers must learn to drive more safely and demand safer cars to drive. Likewise, insurance companies must work to find more modern, efficient, more responsible systems of

Search terms: Insurance rates; Insurance industry; Accident costs; Property damage accidents; Fatalities; Injury costs; Insurance denial; Damage costs; Liability insurance; Accident rates

HS-009 429 Fld. 4/6

ASSUMPTIONS VERSUS FACTS

by Ralph D. Semerak

Published in *Trial* v6 n6 15-6, 19 (Oct-Nov 1970)

The Non-Fault Auto Insurance Plan proposed by Governor Nelson D. Rockefeller of New York does away with the concept that persons should be liable for the consequences of their wrongdoings. It abolishes all courses of action for personal injury or property damage based upon the negligent operation of an automobile within the state. But the plan, contrary to its claims, neither provides for victims nor protects owners. There are also other factors which work against the plan: administrative costs will be increased for insurance companies, the new type of non-fault claim will lead to a proliferation of claims, non-fault programs are an invitation to fraud, there will be a tendency to pad bills. The total value of the plan is, at best, questionable.

Search terms: Insurance laws; Liability insurance; Insurance rates; Insurance claims; No fault insurance plan; Negligence; Insurance fraud; Accident compensation

HS-009 430 Fld. 4/6

THE AUTOMOBILE INSURANCE PROBLEM

Anonymous

Published in *Trial* v6 n6 p8-11 (Oct-Nov 1970)

With compulsory financial responsibility

age of consumerism raising serious doubts about the nonfunctioning of marketing techniques — automobile insurance and automobile reparations are a political issue. There are controversies over the profits of the insurance industry, the drying up of its capacity to write new insurance, rating practices and the solvency of firms to be guaranteed by the federal government or big private funding and state regulation. Six plans for non-fault insurance are outlined.

Search terms: Insurance rates; Insurance industry; Insurance cancellations; No fault insurance plan; Fault; Compulsory insurance; Torts; Financial responsibility; Insurance laws; Insurance denial

5/0 VEHICLE SAFETY

5/1 Brake Systems

HS-009 431 Fld. 5/1

GENERAL MOTORS ENGINEERING STAFF TEST PROCEDURES FOR THE LABORATORY EVALUATION OF BRAKE LINING MATERIALS

by Frank H. Highley

General Motors Corp.

Sep 1969 36p
Report no. GM-Eng-Pub-A-2604

The test procedures currently used by General Motors Engineering Staff for the laboratory evaluation of brake lining materials are described in detail, including drum preparation, control of drum heating and cooling rates, specimen preparation, run-in procedure, friction and wear tests, vehicle fade and recovery simulation test, frictional characteristics stabilization test, brake lining speed sensitivity test, and moisture sensitivity test procedure.

Search terms: Brake drums; Brake linings; Brake lining wear; Friction tests; Brake fade; Moisture tests;

ELECTRONICS ON WHEELS

by Anthony Curtis

Published in *Motor* (London) n3573
p25-7 (26 Dec 1970)

Two experimental electronic antilock braking systems, developed by two electrical component manufacturers, Bosch and Lucas, and essentially similar, are described and discussed. Discussed also are an electronic fuel injection system.

Search terms: Brake systems; Anti-locking devices; Electronic fuel injection

HS-009 433 Fld. 5/1

BRAKE THROUGH

Anonymous

Published in *Motor* (London) n3573
p40-1 (26 Dec 70)

Mercedes has developed, in partnership with Teldix an anti-locking brake system that seems very efficient, called the Anti-Bloc-System or ABS. It will be offered on one or two Mercedes models about the middle of 1971 and should become an option throughout the range in 1972. There is an electronic sensor on each wheel which measures the rotational velocity and transmits this information to an electronic control unit. The ABS has an unique method of controlling hydraulic pressure which reduces braking effort by "bleeding" the line to the brake and pumping back the small amount of fluid it extracts to keep the total quantity in the line constant. Stopping distance has been greatly improved except possibly on ice.

Search terms: Brake system design; Electronic devices in vehicles; Anti-locking devices; Hydraulic brakes; Braking optimization; Brake performance; Daimler Benz; Teldix

BRAKING OF MOTOR VEHICLES AND THEIR TRAILERS. TERMINOLOGY. 1ST ED.

International Organization for Standardization

Aug 1967 11p
Report no. ISO-R-611-1967(E)

This ISO Recommendation relating to braking terminology deals with the definitions of the main terms used in connection with braking. These terms may designate either material parts which are actuated when a braking system is operating or quantities which are involved in the whole or a part of this operation.

Search terms: Braking; Trailers; Brake systems; Nomenclature; Transmissions; Retarders

HS-009 435 Fld. 5/1

EVALUATE ALLOYS FOR BRAKE DRUMS

by S. K. Rhee; W. M. Spurgeon; J. L. Turak

Published in *SAE Journal* v78 n6 p20-3
(Jun 1970)

Reductions in brake operating temperature curtail drum wear, lining wear and fade. It has been suggested that operating temperatures be lowered by using drum materials with high heat capacity and thermal conductivity - specifically copper. While superficial cost comparisons rule the copper drums out of automobiles, the copper drum could find application in trucks or fleet automobiles. The technical feasibility of using chromium-copper alloy rotors in automotive brakes has been demonstrated through the stage of inertial dynamometer tests. The copper alloy drum runs cooler and causes less fluctuation in line pressure than the standard cast-iron drum.

thermal factors; Brake drum materials; Wear tests; Brake drums; Alloys

5/3 Cycles

HS-009 436 Fld. 5/3; 4/1

SAFETY DEVICES PARTICULAR TO MOTORCYCLES DUE TO THEIR CONSTRUCTION

Midget Motor Manufacturers' Assoc. of Japan.

20 Feb 1967 65p

Bound with *Other Measures to Improve Safety for Motorcycles, and Report of Comparative Test on Driving Ease and Difficulty of Motorcycles by Classification.*

Safety standards for motorcycles included in this report are: independently operated two braking systems; riding posture; banking angle; side stand; kick starter arm; shapes of protrusions; rear-view mirror; location of switches; turn signal; lumps and reflectors and their attaching parts; glare reduction; separate type passenger seat; passenger seat belt or grip type holder; exhaust muffler; fuel tank and its attaching parts; and, radio interference suppression. The radio interference standard requires compliance with two Japanese Industrial Standards for automobiles. These are included.

Search terms: Motorcycle safety standards; Radio interference; Japan

HS-009 437 Fld. 5/3; 3/3; 3/10

OTHER MEASURES TO IMPROVE SAFETY FOR MOTORCYCLES

Midget Motor Manufacturers' Assoc. of Japan.

20 Feb 1967 12p

Bound with *Safety Devices Particular to Motorcycles Due to Their Construction.*

tion, and Report of Comparative Test on Driving Ease and Difficulty of Motorcycles by Classification.

Recommended measures to improve safety for motorcycles include licensing procedures similar to those in Japan which separate motor bikes which operate at slow speed, small and light-weight motor bikes, and motorcycles for operating at high speed (51cc and over), and have separate driver requirements for each group. European countries have a similar system. Protective headgear should be categorized into two or more types to give varying amounts of protection, depending on type of motorcycles being ridden. Design of this headgear should be undertaken from a human engineering viewpoint to avoid the possibility that the headgear fall into disfavor and disuse because of its weight.

Search terms: Motorcycle safety; Licensing; Headgear; Motorcycle operator licensing; Japan; Europe

HS-009 438 Fld. 5/3; 3/3; 3/4

COMPARATIVE TEST ON DRIVING EASE AND DIFFICULTY OF MOTORCYCLES BY CLASSIFICATION

Midget Motor Manufacturers' Assoc. of Japan

Nov 1964 23p

Bound with Safety Devices Particular to Motorcycles Due to Their Construction, and Other Measures to Improve Safety for Motorcycles.

Motor bikes (under 125cc) and light motorcycles (126-250cc) were tested to determine driving skills required. Both men and women drivers participated except that the women declined to ride the light motorcycles (126-250cc) in the slalom test. They did participate in the rugged road test. In the slalom test, the

shorter time. The women scored a higher number of demerits in the rugged road test than the men did, demonstrating that the delicate skills peculiar to female drivers were of no avail on this course. Both men and women scored an increasing number of demerits as the weight of the motorcycles increased.

Search terms: Motorcycle operators; Motorcycle characteristics; Driver performance; Road tests; Motorcycle power; Sex factors in driving

5/4 Design

HS-009 439 Fld. 5/4

AUTOMOTIVE QUICK-HEAT SYSTEM: COMBUSTION TECHNIQUES

by F. E. Kalivoda; J. H. Hoffman

Stewart-Warner Corp.

7p 7refs

Report no. SAE-710035

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

The excellent performance of the modern automobile environmental control system tends to accentuate the passenger discomfort experienced during the engine warm-up period in very cold weather. Quick-heat systems utilizing combustion techniques can significantly reduce this warm-up period and can not only improve comfort, but also contribute to safety and improved engine life. These factors are discussed, together with details of a quick-heat system which reduced the warm-up time of a large American automobile by over 80% in actual tests.

Search terms: Quick heat systems; Combustion; Engine heaters; Engine operating conditions; Cold weather starting

HS-009 440 Fld. 5/4

NEW FLAME RETARDANT PLASTICS AND REQUIREMENTS IN THE AUTO INDUSTRY

by Kiyo Hattori

Dart Industries, Inc.

1971 6p 16 refs

Report no. SAE-710099

Presented at Automobile Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

Two new reinforced thermoplastic products with outstanding flame retardant properties are described. These products are designed for critical uses requiring flame retardancy beyond the new motor vehicle safety standard dealing with flammability of vehicle interiors. The motor vehicle safety standard test method is described and burning test results of several plastics given. Other standard flammability test methods are presented as means for testing plastics depending on the end use requirements.

Search terms: Flammability; Thermoplastics; Vehicle safety standards; Materials tests; Temperature endurance tests; Flammability tests; Plastics; Interior design; Heat resistance; Laboratory tests

AVAILABILITY: SAE

HS-009 441 Fld. 5/4

SPECIALTY CARS. DODGE CHALLENGER, PLYMOUTH 'CUDA, MUSTANG BOSS, CHEVROLET MONTE CARLO

Published in *Consumer Reports* v35 n5 p294-9 (May 1970)

The auto manufacturers often refer to specialty cars as "personal transportation." The trunks of some specialty cars hold far less luggage than most

5/4 Design (Cont'd.)

HS-009 441 (Cont'd.)

noisily than sedans, especially under a full load; and the rear seat of most aren't intended to hold adults in any comfort for any appreciable length of time. Tests were performed on these cars by CU and design deficiencies and assembly defects are brought to light.

Search terms: High powered automobiles; Automobile comparisons; Luxury automobiles; Automobile defects; Automobile models; Automobile tests; Automobile performance; Vehicle riding qualities

HS-009 442 Fld. 5/4; 5/1; 5/14

AUTO SAFETY

by Jan P. Norbye; Jim Dunne

Published in *Popular Science* v197 n4 p76-7 (Oct 1970)

The 1971 cars show how far we have come in safety improvements. Federal government standards were responsible for many of these improvements along with the auto industry through its own research programs. Many other safety features are needed and are being investigated. Brakes and air bags are briefly discussed.

Search terms: Safety devices; Brake design; Air bag restraint systems; Automobile safety standards; Automobile safety characteristics

HS-009 443 Fld. 5/4; 5/6; 5/11

SAFETY IMPROVEMENTS AND CONCEPTS RELATED TO VEHICLE DESIGN

by K. A. Stonex

General Motors Res. Labs.

1970 16p

Prepared for annual meeting, Western Section, Institute of Traffic Engineers, San Francisco, 21 Jul 1970.

The three areas of motor vehicle transportation that will receive primary attention during the decade of the 1970's, not only on the part of the manufacturer, but on the part of the consumer, are safety, emission controls, and repairability. New means of achieving healthy improvement in each of these areas are well underway. By the mid-1970's there should be measurable gains reflected in statistics regarding lowering of traffic fatalities and injuries, vehicle-caused pollution, and repairability costs. These improvements will stem from such developments as the air cushion, more stringent emission controls, and redesigned bumper systems. The auto industry not only expects to achieve such improvements - its current design and development work indicates that it should.

Search terms: Vehicle safety; Emission control; Repairing; Fatality prevention; Injury prevention; Air cushions; Bumper design; Vehicle design; Repair costs; Safety design; Air pollution emission factors; Air bag restraint systems

5/6 Fuel Systems

HS-009 444 Fld. 5/6

EXHAUST EMISSIONS FROM PRIVATELY OWNED 1966-70 CALIFORNIA AUTOMOBILES. A STATISTICAL EVALUATION OF SURVEILLANCE DATA

by Arthur J. Hocker

California Air Resources Lab.

30 Oct 1970 39p
Report no. QPR-20-Supp

Data on emission levels vs. mileage for 1966 through 1970 model cars are subjected to statistical evaluation. Gross regressions of hydrocarbons and carbon monoxide are calculated with 95% con-

fidence limits. The 1970 models all show much lower emission levels than the 1969's at the same point in time, however, the standards are lower for the 1970's.

Search terms: Exhaust emissions; Statistical analysis; Statistics; Carbon monoxide; Hydrocarbons; Exhaust emission tests; Regression analysis; Confidence intervals

HS-009 445 Fld. 5/6

NATURAL GAS FUELED ENGINES HAVE LOWER EXHAUST EMISSIONS

by R. W. McJones; R. J. Corbeil

Published in *SAE Journal* v78 n6 p30-4 (Jun 1970)

Exhaust emissions from dual-fuel automobiles running on natural gas are below most existing and proposed emissions standards, including those set for California's hypothetical clean car. Emissions with natural gas are also substantially below those from the same engine using gasoline. Though conversion to dual-fuel operation is simple and requires no internal engine modifications, dual-fuel systems are currently economic only for fleet use. The hydrocarbon, carbon monoxide, and nitrogen oxides emissions of engines using natural gas are discussed.

Search terms: Hydrocarbons; Natural gas automobiles; Nitrogen oxides; Dual fuel vehicles; Engine operating conditions; Emission standards; Engine conversion; Exhaust emissions; Carbon monoxide

HS-009 446 Fld. 5/6; 5/4

WHAT FUTURE FOR THE INTERNAL COMBUSTION ENGINE? LEGISLATION AGAINST AIR POLLUTION BY VEHICLE ENGINES HAS BROUGHT EVER-INCREASING DESIGN PROBLEMS

by Edward Eves

Published in *Autocar* v133 n3896 p2-4, 6 (5 Nov 1970)

Much concern over air pollution has created engine design problems for automobile manufacturers. Steam engines and electric engines were studied but found to have many odds against them. The internal combustion engine appears to be an alternative but is up against some regulations. Studies were made in Los Angeles, which has the world's worst smog problem, and the cause of this smog is discussed. Methods for reducing nitrogen oxide emissions are described.

Search terms: Internal combustion engines; Steam automobiles; Nitrogen oxides; Emission control; Los Angeles; Smog; Temperature inversions; Air pollution emission factors; Engine design; Electric automobiles

HS-009 447 Fld. 5/6

CONTROLLING ENVIRONMENTAL POLLUTION. A PROGRESS REPORT

by Henry Ford, 2nd.

Ford Motor Co.

10 Dec 1970 18p

In an effort to develop an essentially pollution-free car, Ford Motor Company joined with six oil companies and four foreign auto manufacturers to find the best combination of engine design, exhaust control system design, and fuel consumption. The joint effort, Inter-Industry Emission Control, has met its goals and in 1971 Ford Motor Company will start 50,000 mile road tests of cars equipped with complete IIEC systems. From this research effort, Mr. Ford thinks that his company can produce cars in 1975 that would meet the IIEC goals and would also meet the original

Search terms: Emission standards; Exhaust emission control; Vehicle air pollution; Air pollution control devices; Inter Industry Emission Control Program; Air pollution emission factors; Engine design; Exhaust systems; Measuring instruments; Fuel composition

HS-009 448 Fld. 5/6

GETTIN' THE LEAD OUT

by John Ethridge

Published in *Motor Trend* v22 n5 p48-50 (May 1970)

Unleaded gasoline will cause a \$1 billion to \$3.5 billion annual increase in fuel costs to the consumer, it will result in less power from engines, and be responsible for poorer gas mileage. It is suggested that the auto emissions problem should be studied further in regard to leaded fuels and air pollution.

Search terms: Fuel additives; Lead free gasoline; Fuel costs; Fuel economy; Gasoline mileage; Air pollution emission factors; Engine operating conditions

HS-009 449 Fld. 5/6

EFI: A SQUIRT IN THE RIGHT DIRECTION. ELECTRONIC FUEL INJECTION COULD BE THE VITAL LINK IN ENABLING THE INTERNAL COMBUSTION ENGINE TO MEET STRINGENT EMISSION STANDARDS

by Karl Ludvigsen

Published in *Motor Trend* v22 n11 p60-3 (Nov 1970)

Tests conducted by Bendix Corporation indicate that automobiles equipped with electronic fuel injection may be promis-

Many European cars are equipped with an EFI system.

Search terms: Electronic fuel injection; Engine design; Fuel injection; European vehicles; Engine operating conditions; Internal combustion engines

HS-009 450 Fld. 5/6

EFFECT OF FUEL COMPOSITION ON EXHAUST EMISSIONS FROM A SPARK-IGNITION ENGINE

by Ralph D. Fleming

Bureau of Mines

Sep 1970 74p 39 refs

Report no. RI-7423; PB-194 942

A single cylinder research engine was operated on pure hydrocarbons and simple (two component) mixtures of pure hydrocarbons to study the effect of fuel composition on exhaust emissions from a spark-ignition engine. Used as fuels were three pure hydrocarbons that represented the primary hydrocarbon types present in commercial motor fuel: a paraffin (2, 2, 4-trimethylpentane), an olefin (2, 4, 4-trimethylpentene-2), and an aromatic (meta-xylene). The results of the exhaust gas analyses showed that ethylbenzene, 1-methyl-3-ethylbenzene, and 1-methyl-3-vinylbenzene were more abundant in the exhausts of the paraffin-aromatic and olefin-aromatic mixtures than in the m-xylene exhaust. The amount of total hydrocarbon (moles of exhaust hydrocarbon per mole of fuel used) decreased in the following order: pure paraffin, pure olefin, to pure aromatic. The unreacted hydrocarbon mole-fractions in the pure fuel exhaust were 0.20 for the paraffin, 0.13 for the olefin, and 0.66 for the aromatic.

Search terms: Fuel composition; Exhaust emission tests; Spark ignition engines; Paraffins; Olefins; Aromatic

5/9 Inspection

HS-009 451 Fld. 5/9

TIPS ON PRE-TRIP INSPECTION

by Jim Bald

Published in *Fleet Owner* v65 n12 p55-9 (Dec 1970)

Although most fleets pay only lip service to vehicle pre-trip inspections and safety lane checks because they question the time and expense involved, it is possible to provide efficient and economical means of inspecting rigs by establishing a workable frequency for inbound safety lane inspections; enforcing Bureau of Motor Carrier Safety regulations requiring drivers to make pre-trip inspections; and by sharpening the observation techniques of both safety lane personnel and drivers.

Search terms: Inspection effectiveness; Inspection frequency; Truck maintenance; Preventive maintenance; Inspection procedures

5/14 Occupant Protection

HS-009 452 Fld. 5/14

STUDY ON THE USE OF SAFETY BELTS

by Liisa Ratilainen; Mikko Korkea-aho

Central Organization for Traffic Safety in Finland

Published in *Reports from TALJA* n10 p24-32 (1970)

This study was published in Finnish in *Taljan tutkimuksia*, no 17, 1969.

The purpose of the study was to ascertain to what extent passenger cars are equipped with safety belts, to what extent they are used, and which factors may have effect on use. The effect of different factors has been studied by

characteristics of drivers as well as factors relating to driving circumstances and vehicle, and by an opinion poll, which was to reveal the drivers' opinions of the safety belts and their use. Interviews were conducted with 8,510 drivers. It was found that in 1968 45.6% of cars had safety belts; of these, 43.6% were in use at time of interview. Both percentages showed improvement from the two previous years.

Search terms: Driver interviews; Seat belt usage; Seat belts; Seat belt statistics; Safety belts; Opinion polls; Psychological Factors; Driver characteristics; Driver attitudes

HS-009 453 Fld. 5/14; 5/4

FORD "S" FRAME

by N. Baracos; A. Rhodes

Ford Motor Co.

1969 23p 10 refs
Report no. SAE-690004

Presented at the International Automotive Engineering Congress, Detroit, Mich., 13-17 Jan 1969.

Test results show the 1969 Ford/Mercury "S" frame design offers significant seat belt load reductions as well as improved passenger compartment integrity. Authors believe such an impact absorbing front end will reduce the incidence of fatalities and severe injuries.

Search terms: Occupant protection; Passenger compartments; Seat belt loading; Front end collisions; Energy absorbing frames; Impact tests; Fatality prevention; Head on collisions; Injury prevention; Crashworthy bodies; Impact severity; Ford Motor Co.; Frame tests

AVAILABILITY: SAE

HS-009 454 Fld. 5/14

MOTIVE SEAT SPRING ASSEMBLIES

by Gerald D. Robinson

Lear Siegler, Inc.

1971 14p
Report no. SAE-710041

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

A new quality control system has been installed in three seat manufacturing plants. Aspects described are: new photographic type assembly gauges; new gauges for springs which hold the springs in the exact manner in which they are supported in the seat assembly; quality approval and rejection systems for evaluating die tooling and produced parts at both the beginning and end of the production runs; a quality control training program for new employees; methods of inspecting raw material upon receipt before production is begun; flex testing of final assemblies to make certain that all seat deflection and contour specifications are met.

Search terms: Seats; Springs; Quality control; Inspection procedures; Manufacturing inspection

AVAILABILITY: SAE

HS-009 455 Fld. 5/14

UCLA-ITTE ENGINEERS RESEARCH A SAFER SEAT

by Derwyn M. Severy; Harrison M. Brink; Jack D. Baird; David M. Blaisdell

Published in *SAE Journal* v78 n6 p24-8 (Jun 1970)

High-performance bucket and bench seat designs have been developed by Institute of Transportation and Traffic Engineer-

impact tolerances of their safety seat design are described.

Search terms: Seat design; Seat tests; Bucket seats; Safety seats; Seat loading; Impact tolerances; Bench seats

HS-009 456 Fld. 5/14

NBS RESEARCH SEEKS SAFER AUTOMOBILES DURING '70s

Anonymous

Published in *Commerce Today* v1 n3 p29-31 (16 Nov 1970)

The National Bureau of Standards has conducted studies to test the reliability of webbing in seatbelts. The results of these studies are described. Dummies were used to test the entire restraint system in an automobile.

Search terms: Webbing; Seat belt tests; Reliability; Materials tests; Restraint systems; Dummies; Wear tests

HS-009 457 Fld. 5/14; 3/1; 5/4

NEW TRENDS IN VEHICLE SAFETY

by George R. Smith

General Motors Corp.

1970 45p

Presented at Society of Manufacturing Engineers, Danbury, Conn., 16 Sept 1970.

There are two rather hotly debated issues swirling around automotive safety today. One of these has to do with improving the second collision environment for vehicle occupants; the other involves the drinking driver. Just about everyone has some kind of advice to offer on the first issue, but the second, probably the greatest single factor contributing to vehicle death and injury in this country today, only causes the

despair. Air cushion systems and their component parts are explained, and impact tests with dummies are discussed. Tests conducted by GM with drinking drivers are discussed.

Search terms: Drinking drivers; Energy absorbing bumpers; Impact tests; Air bag restraint systems; Bumper design; Alcohol detection and interlock system; Test equipment; Test facilities; Driver intoxication; Driver tests

HS-009 458 Fld. 5/14

WASHINGTON TELLS DETROIT: CURE AUTO ACCIDENTS NOW

by James Wargo

Published in *Product Engineering* v41 n12 p11-4 (8 Jun 1970)

Differences between the government and industry on the what and when of a passive restraint system for passengers center around the government's desire to speed up installation and industry's concern that acceptance of a system before it is fully proven could lead to a host of liability suits. Ford and General Motors have each developed an air bag and GM has begun advanced testing of an electronic crash sensor. Chrysler is experimenting with a solid propellant gas generator. In addition, two Japanese car manufacturers are working on passive restraint systems, Toyota on a freon/air-inflated gas bag and Nissan Motor Company on a rear-seat net system. All manufacturers, foreign and domestic seem to agree that the 1973 model deadline cannot be met with a safe, effective system.

Search terms: Air bag restraint systems; Air bag inflation devices; Sensors; Propellant actuated devices; Passive restraint systems

5/15 Propulsion Systems

HS-009 459 Fld. 5/15; 5/2; 5/6

THE FREON ENGINE: WILL IT WORK?

Published in *Commercial Car Journal* v119 n4 p90-2 (Jun 1970)

The freon engine designed by Wallace Minto has been purchased by Dallas Transit for further development as an external combustion engine for transit buses under a contract with DOT. The aim is to eliminate air pollution and noise. Ling-Temco-Vought is doing the actual development work. Although freon has many desirable qualities, one problem is to keep the system sealed and under pressure. Some practical results are expected in 12 to 18 months.

Search terms: Freon engines; Air pollution control; External combustion engines; Buses

HS-009 460 Fld. 5/15; 5/6

THE FREON ENGINE

by H. L. Miller

Published in *World Car Guide* n154 p28-31 (Dec 1970)

A freon engine developed by Wallace L. Minto will be installed in Datsun cars and trucks. About one hundred of the engines are scheduled to be highway tested by 1972. Janmar Diesel Company will use a larger version for boats, and tractors. The engine uses Freon instead of steam to produce the propellant power. Fumes from this power plant are harmless carbon dioxide. In addition, the engines should cost 50-75% less than comparable internal combustion engines.

Search terms: Datsun; Engine design; External combustion engines; Freon engines; Engine performance; Air pollution emission factors; Vehicle operating costs; Minto freon automobiles

HS-009 461 Fld. 5/15

THE NEW WORLD OF ROTARY ENGINES

5/15 Propulsion Systems (Cont'd.)

HS-009 461 (Cont'd.)

by Ron Hickman

Published in *Road Test* v6 n7 p12-9 (Jul 1970)

The rotary or Wankel engine has almost the same thermodynamic cycle as the conventional reciprocating internal combustion engine. The major structural difference is that there are no reciprocating parts on the rotary engine. The advantages of the rotary engine over the reciprocating engine are described, and the plans of various foreign manufacturers to use this engine are outlined. The emission control problems of Wankel engines are briefly discussed.

Search terms: Wankel engines;
Rotary engines; Reciprocating engines;
Emission control

limited to small perturbations. It can also serve as a valuable aid to understanding the more complex output/input relationships that occur in the large perturbation, nonlinear ranges of automobile operation. This report has shown that response predictions based on simple linear models, for separate ride and lateral-directional motions, can be made to "fit" the SVA-BPR simulation results for small input levels (e.g., a ride disturbance of one inch amplitude with no cornering, and a lateral acceleration of 0.25g on flat, horizontal terrain). However, as the magnitudes of the inputs are increased, the computer simulation exhibits effects of nonlinearities that are beyond the scope of linear theory but are well known in competition driving. The presented comparisons also constitute additional, indirect evidence of the detailed validity of the SVA-BPR simulation in the small perturbation range.

Search terms: Vehicle riding qualities; Cornering; Ride simulators; Forecasting; Lateral acceleration; Equations of motion; Lateral forces; Vehicle control; Mathematical analysis; Vehicle dynamics; Computerized simulation; Perturbation; Linear systems; Nonlinear systems

HS-009 463 Fld. 5/18; 4/5

VEHICLE DYNAMICS TERMINOLOGY

Society of Automotive Engineers

Jun 1970 19p
Report no. SAE-J670b

Report of Vehicle Dynamics Committee approved Jul 1952 and revised May 1970. Conforms in part with American National Standard Acoustical Terminology ANS Z24.1.

This revision of "Vehicle Dynamics Terminology, SAE J670b" has been expanded by the Vehicle Dynamics Committee to encompass terminology related to directional control of vehicles. Revisions have also been made to update

the original terminology, and an alphabetical index has been appended to facilitate location of definitions. The function of uniform terminology is to promote understandable and exact communication. A great deal of effort has been expended to make these definitions suit this purpose.

Search terms: Vehicle dynamics;
Nomenclature; Dictionaries

HS-009 464 Fld. 5/18; 4/5

POEM — A COMPUTER- ASSISTED PROCEDURE FOR OPTIMIZING ELASTOMERIC MOUNTINGS

by Daniel Zibello, Jr.; Frank M. Thompson

Enjay Chemical Co.

11p 13 refs
Report no. SAE-710057

Presented at Automotive Engineering Congress, Detroit, Mich., 11-15 Jan 1971.

A Procedure for Optimizing Elastomeric Mountings (POEM) is described which provides a systematic investigation of vehicle ride performance as a function of both the spring rate and damping of a selected mounting. POEM assumes the mounting design and its placement on the vehicle have been established. Then nine mounts satisfying a three-level factorial experiment in spring rate and damping are evaluated. Evaluations can be subjective or objective and can employ laboratory simulators or road tests. Dynamic properties of the mounts are measured at simulated on-car conditions. Computer, step-wise regressions of the data are performed to define any performance/property relationships. Final regression equations are contoured by computer, displaying performance versus dynamic properties. Results enable easy and quantitative optimization of dynamic properties. Examples of POEM analyses are given.

5/18 Steering Control System

HS-009 462 Fld. 5/18; 4/7 AUTOMOBILE DYNAMICS — COMPARISONS OF CORNERING AND RIDE RESPONSE PREDICTIONS WITH LINEAR THEORY AND WITH A NON- LINEAR COMPUTER SIMU- LATION. FINAL REPORT.

by E. Eugene Larrabee

Cornell Aeronautical Lab., Inc.
Massachusetts Inst. of Technology

May 1969 50p 5 refs
Report no. CAL-VJ-2251-V-5

Sponsored by Cornell Aeronautical Lab., Inc., under Internal Research Order 85-252 and Bureau of Public Roads.

Linear theory can give considerable insight into the ride and lateral-directional motions of automobiles, when the motions are treated separately and are

Search terms: Suspension systems; Damping; Spring rates; Engine mounts; Elastomers; Vibration; Regression analysis; Vehicle riding qualities; Computerized simulation; Vehicle dynamics; Vehicle performance

AVAILABILITY: SAE

HS-009 465 Fld. 5/18

DESIGN, TESTS ENSURE SUSPENSION SURVIVES A RAP ON THE KNUCKLE

by Robert J. Templin; John T. Hoban; Casmir J. Cislo; Melvin W. Devers; William B. Larson

Published in *SAE Journal* v78 n3 p43-5 (Jun 1970)

A design for a cast iron steering knuckle evolved from a development program to simplify the nine-piece assembly installed on the heaviest Cadillac limousines and ambulances. The resultant two-piece design (casting and shrunk-in spindle) not only eliminated fasteners and the chance for human error, it exceeded the performance of the fabricated assembly in vehicle and laboratory tests.

Search terms: Steering knuckles; Cast iron; Laboratory tests; Field tests; Materials tests; Suspension systems

5/19 Theft Protection

HS-009 466 Fld. 5/19

LOCK YOUR CAR

Anonymous

Published in *Journal of Insurance* v31 n3 p30-3 (May/June 1970)

The National Automobile Theft Bureau and the insurance industry have launched "lock your car" campaigns in many metropolitan areas. In 1969 the

the ignition and four out of five cars stolen were unlocked. It was found that in cities where campaigns were launched, car thefts actually declined.

Search terms: Theft prevention; Theft; Stolen vehicles; Ignition keys; Door locks

5/20 Trucks and Trailers

HS-009 467 Fld. 5/20

TRACTION CHARACTERISTICS OF TRUCKS AND TRUCK COMBINATIONS. 1ST ED.

Western Highway Inst.

Jan 1969 146p

Report no. Research—Committee—1

The following basic full scale traction tests of heavy duty trucks are reported: truck pull-down tests; truck rolling resistance tests; passenger car pull-down tests; and passenger car skid tests. The passenger car tests were incorporated into the program to provide correlation of results both with truck and other traction tests.

Search terms: Tire rolling resistance; Trucks; Skid resistance tests; Automobiles; Tire traction; Road grades; Truck performance; Tire rolling resistance; Truck tractors; Load transfer; Traction; Tire chain traction; Differentials; Sanding; Dynamic loads; Wheel bases; Horsepower; Coefficient of friction; Truck tires; Dynamic loads; Inflation pressure; Hydroplaning; Acceleration; Sideslip; Vehicle control; Road surfaces; Shear stress; Drive axles; Fifth wheel devices

HS-009 468 Fld. 5/20

TRUCK ABILITY PREDICTION PROCEDURE

Society of Automotive Engineers, Inc.

SAE Handbook supplement 82. Report of Transportation and Maintenance Com., approved Oct 1951, rev. May 1958.

The purpose of this report is to provide a practical method for the prediction of truck performance using accepted data. It is designed to help anyone concerned with the problem of truck selection. By following directions, it is possible to determine the necessary information for intelligent truck selection, without being concerned with the origin or derivation of the complex factors involved. With readily available specifications of a truck, information provided in the tables or charts, and a minimum of calculation, it is possible to predict the performance obtainable from a truck of given characteristics under given operating conditions and the characteristics required in a truck to meet different performance requirements under given operating conditions.

Search terms: Truck performance; Truck specifications; Truck tires; Truck power

AVAILABILITY: SAE

HS-009 469 Fld. 5/20; 3/2

ERGONOMICS IN MODERN TRUCKS

by John Dickson-Simpson

Published in *Commercial Motor* v1: n3370 p81-3 (1 May 1970)

The effect of vehicle design on a driver's human efficiency can be far-reaching. The relevant ergonomic factors are mostly concerned with positioning the controls in the right place and making sure that the effort needed to operate them strikes a balance between limiting fatigue and preserving sensitivity. To minimize fatigue the steering wheel needs to be high enough to provide adequate knee clearance and yet low enough to avoid cramped angles in the

5/20 Trucks and Trailers (Cont'd.)

HS-009 469 (Cont'd.)

arranged to position minor controls within reach of the driver. Visibility, forward and rear, should permit safe operation for terminal and enroute operations. Ventilation, is an important aspect of safe and comfortable driving. Also add a good cab structure to reduce noise and vibration.

Search terms: Human factors engineering; Noise control; Ventilation; Mirror positioning; Truck drivers; Truck cab interiors; Driver fatigue; Steering wheels; Vibration; Visibility; Control location

5/22 Wheel Systems

HS-009 470 Fld. 5/22

INFRARED TIRE ANALYSIS

by Paul E. J. Vogel

Published in *Rubber Age* v102 n11 p70-1 (Nov 1970)

Infrared tire analysis permits non-destructive testing; simple operation at a modest cost. It has a bright future in such areas as product evaluation in design and research; quality control in manufacturing; carcass inspection before recapping, and annual inspections by state motor vehicle bureaus.

Search terms: Tire tests; Tire defects; Infrared analyzers; Quality control; Tire inspection; Tire quality; Non-destructive tests; Tire test equipment

HS-009 471 Fld. 5/22

FOAM INFLATED TIRES

by J. S. Hawkes

Published in *Rubber Age* v102 n6 p47-53 (June 1970)

Based on a paper presented at 14th Cellular Plastics Div. Technical Conference, Detroit, Mich., 24 Feb 1970.

A new type of foam inflation for pneumatic tires has been found successful in many industrial and military applications. The foam-filled tire concept is described in general terms and the reasons for its success are explained. Effects on tire characteristics, performance properties and limitations, economics and applications of the foam-filled concept are discussed.

Search terms: Foam inflated tires; Pneumatic tires; Tire characteristics; Tire performance; Tire failures; Tire temperature

HS-009 472 Fld. 5/22

CUTS AND CUT GROWTH IN TIRES

by F. N. Brenner; F. W. Barton

Published in *Rubber Chemistry and Technology* v42 n5 p1462-5 (Dec 1969)

Contract FH-11-6090

Forty tires were subjected to severe road use on a course (approximately 3,500 miles) that included Belgian block, over highways at turnpike speeds while overloaded. The course was repeated until the tires were worn smooth. At the end of each course, the number of new cuts and the length of all cuts in grooves was determined. Ten miles of Caliche (sharp stones) road was included between the first and second measuring period. The tires experienced a total of 169 cuts. Forty-seven of these cuts grew, 34 of them less than 0.11 inch. No cut grew continuously throughout the test. The cuts grew but not enough to cause tire failure except in one case where the cut exposed the fabric.

Search terms: Tire loads; Tire tests; Stones; Tire failures; High speed highways; Road tests; Tire wear measurement; Tire cuts

HS-009 473 Fld. 5/22; 5/11; 3/1

MISCELLANEOUS RAMBLINGS ON AUTOMOTIVE SAFETY

by William H. Brittain, Jr.

Published in *Aviation Digest* v16 n12 p32-5 (Dec 1970)

Proper use of radial ply tires, dangers of using two kinds of tires on a car, hazards of driving after drinking, and the need for good maintenance are briefly discussed.

Search terms: Vehicle safety; Radial tires; Drinking drivers; Tire pairing; Automobile maintenance; Tire safety

NHTSA DOCUMENTS

NHTSA Contractors Reports

HS-800 316 Fld. 5/4

FULL-SCALE CRASH TESTS OF RIGID SIMULATED HEAVY VEHICLE UNDERRIDE GUARD. INTERIM TECHNICAL REPORT

by Norman J. DeLays; Kenneth N. Naab

Cornell Aeronautical Lab., Inc.

Mar 1970 85p

Contract FH-11-7317

Report no. CAL-VJ-2844-V-1

Results of six tests of automobiles impacting a rigid simulated heavy vehicle underride guard are presented. The test vehicles represented three general classes of conventional automobiles: small, lightweight rear engine vehicles; standard full-size medium weight automobiles; and a heavy luxury type of automobile. Underride guard clearance above the roadway was varied in the tests for which the nominal impact speeds were 40 mph. Impact loads applied to the rigid underride guard and the dynamic response of the vehicles were recorded, analyzed, and evaluated. It was concluded that an underride guard clearance

of 24 inches above the roadway will protect full size automobiles; a guard height of 18 inches will protect some smaller autos as well as full sized ones; and that substantial upward vertical forces that increase with additional ground clearance are applied by the underriding vehicle.

Search terms: Underride guards; Impact tests; Heavy duty vehicles; Compact automobiles; Rear engine automobiles; Luxury automobiles; Vehicle dynamics; Ground clearances; Impact forces

AVAILABILITY: NTIS

HS-800 506 Fld. 1/1

REFRESHER TRAINING PROGRAM FOR EMERGENCY MEDICAL TECHNICIAN-AMBULANCE INSTRUCTOR'S LESSON PLANS

Dunlap and Associates

Mar 1971 50p
Contract FH-11-7475

Basic Training Program for Medical Technician-W ambulances, publications were announce as HS-800 181; HS-800 182; and HS-800 226.

HS-800 506 Fld. 1/1

REFRESHER TRAINING PROGRAM FOR EMERGENCY MEDICAL TECHNICIAN-AMBULANCE INSTRUCTOR'S LESSON PLANS

Dunlap and Associates

Mar 1971 50p
Contract FH-11-7475

Basic Training Program for Medical Technician-W ambulances, publications were announce as HS-800 181; HS-800 182; and HS-800 226.

This document has been prepared to aid the instructor in conducting a refresher training course for emergency medical

technicians — ambulance. It contains detailed lesson plans for the course, guidelines for developing test materials and guidelines for conducting lessons in which student knowledge and skills are evaluated.

Search terms: Drowning; Childbirth; Ambulance personnel training; Curricula; Instructors; Instruction materials; Instruction manuals; Tests; Evaluation; Airway maintenance; Resuscitation; Transportation of injured; Burns; Injuries; Fractures; Mental disorders; Diabetes mellitus; Hemorrhage; Heart arrest; Pulmonary arrest; Cardiac massage; Cardiopulmonary responses; Shock (Pathology); Cerebrovascular diseases; First aid; Emergency medical services; Epilepsy; Drugs; Occupant rescue; Legal factors

AVAILABILITY: GPO \$1.50

HS-800 507 Fld. 1/1

REFRESHER TRAINING PROGRAM FOR EMERGENCY MEDICAL TECHNICIAN-AMBULANCE COURSE GUIDE

Dunlap and Associates

Mar 1971 30p 8 refs
Contract FH-11-7475

Basic Training Program for Medical Technician-Ambulance publications were announced as HS-800 181; HS-800 182; and HS-800 226.

This "Course Guide" has been prepared to aid in organizing, conducting and standardizing a refresher course for Emergency Medical Technicians — Ambulance. It contains a detailed outline of the course; prerequisites for both students and instructors; suggested scheduling and class size; requirements for facilities, training aids and reference material; and guidelines for conducting the course.

Search terms: Ambulance personnel training; Curricula; Instructors; Instruction materials

AVAILABILITY: GPO \$0.35

NHTSA Staff Speeches, Papers, etc.

HS-810 173 Fld. 4/1; 2/0

STATEMENT BEFORE THE SUBCOMMITTEE ON PUBLIC ROADS, SENATE PUBLIC WORKS COMMITTEE, REGARDING PROPOSED FEDERAL — AID HIGHWAY ACT OF 1970, WEDNESDAY, SEPTEMBER 9, 1970

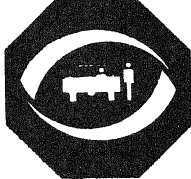
by John A. Volpe

Department of Transp.

1970 19p

Text of Secretary Volpe's testimony on proposed Federal Aid Highway Act of 1970 emphasizes flexibility in providing Federal assistance to State and local transportation systems. Also discussed are provisions affecting the Interstate System, the restructuring of the Federal Aid system in its relation to urban planning, replacement of bridges, and a highway system for U.S. owned territories. The Department of Transportation's responsibility for avoiding, minimizing or overcoming adverse economic, social or environmental impacts relating to highways was discussed along with suggestions for close cooperation with HUD in the areas of housing acquisition, rehabilitation, or relocation as it relates to highway projects. Equal employment opportunity programs are discussed. The establishment of the National Highway Safety Bureau within DOT and its organizational status are also reviewed.

Search terms: Federal aid; Federal state relationships; Interstate Highway System; Highway planning; Highway safety; Highway economic factors; Highway beautification; Housing; National Highway Safety Bureau; Federal laws; Urban planning; Sociological factors; Federal role; Employment; Bridges



executive summary

SYNOPSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REPORT

RELATIONSHIP BETWEEN VEHICLE DEFECTS AND VEHICLE CRASHES FINAL REPORT

The objective of this research program was to determine the extent to which vehicle defects, malfunctions and vehicle subsystem maladjustments cause and contribute to crashes. The results of the project shall provide a significant store of knowledge to be used to improve the safety of vehicles in use. More specifically the results should provide a better basis for discussions affecting the effectiveness and economy of motor vehicle inspection programs.

Contract PH-II-7302
Stanford Research Institute
Menlo Park, California 94025

Award Amount: \$153,400.
Date Report Due: 6-30-70
Date Report Rec'd: 12-9-70

DOT/HS-800 359	Vol. I : Summary Report	PB-195-895
DOT/HS-800 360	Vol. II : Technical Report	PB-195-896
DOT/HS-800 361	Vol. III : An Investigator's Guide	PB-195-897
DOT/HS-800 362	Vol. IV : Case Summaries	PB-195-898
DOT/HS-800 363	Vol. V : An Annotated Bibliography	PB-195-899

INTRODUCTION

The National Traffic and Motor Vehicle Safety Act of 1966 authorized a safety program directed at motor vehicles in use. The research project synopsized here is part of the nationwide accident investigation program of the National Highway Traffic Safety Administration (NHTSA), aimed at obtaining data on all factors related to vehicle accidents. The contract awarded to Stanford Research Institute (SRS) was for the purpose of undertaking a research project focused on the role of component degradation in crash vehicles in which component defects, malfunctions, and maladjustments caused or contributed to the crashes.

The objectives of the study were three:

- Compilation of a bibliography of the available literature

- Development of methodology for crash investigation
- Investigation and analysis of selected crashes, 30 to 40 in number, depending on complexity.

METHODOLOGY

An adapted case study method was employed to investigate crashes in which a component defect was a suspected cause.

Phases of the crash investigation included:

- Notification of occurrence
- Review of police reports
- Measurements and photographing of the site

- Interviews with persons involved
- Acquisition and review of medical records
- Examination and photographing of vehicles, including vehicle autopsy where feasible
- Theoretical analysis and reconstruction of crash events

For purposes of the study, the occurrences investigated included both "accidents" and "disablements". Accidents were those events which, in accordance with the National Safety Council's definition, resulted in personal injury or in property damage other than to a failed part; disablements were the highway events with less serious consequences.

The study objectives were portrayed to law enforcement agencies in the San Francisco Bay Area through oral presentations, and details of the method for deciding whether to call or not call the SRI Crash Analysis Team were described. The California Highway Patrol (CHP) was normally the agency that notified the team of the occurrence of a crash.

The primary study area was defined as the jurisdiction of the CHP's San Jose office, which contains many miles of major highways in incorporated areas of Santa Clara County and all of the County-maintained roads in unincorporated areas north of the town of Morgan Hill. Most of northern Santa Clara County is suburban in character but there are numerous rural roads as well as freeways and urban roads. The usage rates of the roads varied from 10 to over 60,000 vehicle-miles per day in 1969. This is listed in Table I in the report.

To increase the rate of case collection, the study was extended to San Mateo County, which borders Santa Clara County on the north and has similar roadway and traffic conditions. According to preliminary Bureau of Census figures, the total population of the two counties was approximately 1.6 million in April 1970.

All but four of the cases occurred in these two urban counties in northern California where there is random but no periodic motor vehicle inspection. The four cases in areas dissimilar to the Santa Clara/San Mateo region were: One across the Golden Gate from San Francisco, one in Portland, Oregon, one in Wyoming,

MAJOR FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The SRI Crash Analysis Team, with its part-time consultants, included skills in physics, chemistry, medicine, engineering, auto mechanics, and mathematics. Responsibility for investigating and preparing reports on a crash rested with an individual team member who, however, discussed the results at each stage with the project leader and other team members.

The remarks below stem principally from the SRI team's findings on 50 crash cases. It was concluded that each case was probably caused by mechanical defects. Although the 50 cases cannot be assumed to represent northern California's experience of defect-caused accidents or disablements, the results of these investigations are sufficient to indicate some possible approaches to avoiding or alleviating component-caused crashes.

- Incompetent or incomplete servicing may be an important factor in such accidents. A certification or licensing procedure for motor vehicle mechanics is one method currently being considered to help define a level of competence. Indications of the effectiveness of mechanic certification in reducing highway crashes might be gained from a study of the data on mechanical defect accidents in European countries requiring licensing of auto mechanics. A check-off system for auto mechanics, similar to that used in the Federal Aviation Administration's maintenance program, would provide a means for tracing service work to the mechanic who performed it.
- In some of the cases, the owners themselves had either failed to recognize that their vehicles were in unsafe operating condition or decided against having necessary repairs done. These results suggest that consideration should be given to further educating the public in three areas: (1) driver recognition of dangerous vehicle conditions, (2) owner recognition of responsibility for assuring safe vehicle condition, and (3) special driving techniques in emergencies precipitated by component failure.
- Future studies might attempt to obtain more information on the incidence of defects in used cars, comparing, for example, (1) new cars with used cars, (2) used cars purchased from dealers with those purchased from individual owners, and (3) cars sold in a state requiring inspection upon

change of ownership compared with those sold in states requiring no such inspection.

Results of the investigations also showed that of 30 cases with defects in components differentiable in location according to the side of the vehicle, left side defects outnumbered right sides 22 to 8. Such a finding suggests the need for further study of vehicle design in relation to possible systematic unbalanced stress, for example in normal vehicle operation on modern cloverleaf freeway intersections.

Of all methods used to study highway safety, the in-depth case study method probably provides the most depth and breadth of information on all aspects of a particular accident. However, in a study designed to focus on only one aspect of highway accidents, such as the role of vehicle component defects; the full case study method may waste research effort in obtaining data irrelevant to the study focus. To mitigate this problem, three major adaptations of the full case method are suggested:

Wider criteria for inclusion of cases in the study so that "disablements" may be investigated

Purposefully unbalanced coverage of data elements, biased toward those relevant to the particular study focus. In a component defect study, for example, a great deal of information should be collected on vehicle history, and on the pre-crash state of the vehicle insofar as it can be determined from physical, chemical metallurgical, and other analyses.

Simplified case reporting format, to encourage the orderly reporting of all links in the cause-effect chain of the component defect and its result in the vehicle's behavior from pre-crash through post-crash phases. For instance, the GM Long Form could be abbreviated with respect to the information required on each case and adapted to the special purpose of the study.

As distinguished from the modified case studies, statistical studies could be designed to provide more information on the role of vehicle defects in highway crashes. Such studies would require improvements in the data gathered from inspection programs and diagnostic centers, and greater detail in the encoded data on accidents reported by state and county agencies.

The Contract Manager has certified that the Contractor's work has been satisfactorily completed and that all contractual obligations have been met.

The opinions, findings and conclusions expressed in this summary are those of the contractor and not necessarily those of the National Highway Traffic Safety Administration.

Availability of Documents: NTIS, U. S. Department of Commerce, Springfield, Virginia 22151. Order by DOT/HS-numbers or PB numbers. Each volume sells for \$3.00 per paper copy (PC) or 95¢ in microfiche (MF).

